Cambridge Assessment International Education

Cambridge O Level

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **October/November 2020**

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **8** printed pages.

© UCLES 2020

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

© UCLES 2020

Mathematics Specific Marking Principles

1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

© UCLES 2020

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	13 950 final answer	**3**	**M1** for 13 000 × 0.15 oe **M1** for 24 × 500 oe
1(b)	325	**2**	**M1** for $\frac{100-12}{100}x = 286$ soi
1(c)	0.82	**2**	**B1** for answer 0.81[6…] or **M1** for $\frac{0.71}{0.87}$ oe
1(d)	5.51 or 5.52	**4**	**M2** for $1500\times\left(1+\frac{1.9}{100}\right)^5$ oe or **M1** for $1500\times\left(1+\frac{1.9}{100}\right)^k$ oe where $k > 1$ or after M0, **SC1** for $1500\times\left(1+\frac{1.9}{100}\right)^5+1500$ AND **M1** for $\frac{1500\times1.9\times5}{100}+1500$ oe
2(a)(i)	Correct cumulative frequency diagram	**3**	**B2** for at least 4 correct points plotted or **B1** for 10, 30, 64, 76, 80 soi
2(a)(ii)(a)	Correct reading at CF of 40	**1**	**FT** *their* cumulative frequency diagram
2(a)(ii)(b)	24 to 28	**2**	**FT** *their* cumulative frequency diagram **B1FT** for correct reading of *their* LQ or *their* UQ
2(b)(i)	2.06[25] or 2.063 or $2\frac{1}{16}$	**2**	**M1** for ([0 × 24] + 1 × 30 + 2 × 50 + 3 × 32 + 4 × 16 + 5 × 8) ÷ 160
2(b)(ii)	$\frac{24}{160}$ oe	**1**	

Question	Answer	Marks	Partial Marks
2(b)(iii)	$\frac{29}{848}$ oe	**2**	**M1** for $\frac{30}{160}\times\frac{29}{159}$ After M0, **SC1** for answer $\frac{9}{256}$ oe
3(a)	2.04 or 2.035 to 2.036	**1**	
3(b)	Correct smooth curve	**3**	**B2FT** for 8 or 9 points correctly plotted or **B1FT** for 6 or 7 points correctly plotted
3(c)	Tangent drawn at (1, 2.25)	**B1**	
	–2 to –1.1	**B1**	Dependent on close attempt at tangent
3(d)(i)	Ruled line through (0, 3) and (6, 0)	**2**	**B1** for short or unruled line or for two correct points soi or line with negative gradient passing through (0, 3)
3(d)(ii)	Reading at intersections of line with curve	**2**	**Strict FT** intersections of *their* line with *their* curve **B1FT** for each
3(d)(iii)	$A = -12$ $B = 8$	**3**	**B2** for $6x^2 - 24x + 16$ [= 0] or $3x^2 - 12x + k$ [= 0] or $3x^2 - kx + 8$ [= 0], $k \neq 0$ or **M1** for using given equations to form an equation in x $3-\frac{x}{2}=\frac{x}{4}+\frac{2}{x}$ oe or $2\left(\frac{x}{4}+\frac{2}{x}\right)+x=6$ oe
4(a)(i)	$\pi\times\left(\frac{9}{2}\right)^2\times16=\frac{1}{2}\times\frac{4}{3}\times\pi\times r^3$	**M2**	**M1** for $\pi\times\left(\frac{9}{2}\right)^2\times16$ oe or $\frac{1}{2}\times\frac{4}{3}\times\pi\times r^3$ oe
	$r^3=\frac{3}{2}\times\left(\frac{9}{2}\right)^2\times16$ or $r=\sqrt[3]{\frac{3}{2}\times\left(\frac{9}{2}\right)^2\times16}$	**M1**	
	$r = 7.862...$	**A1**	
4(a)(ii)	1030 or 1040 or 1034.6 to 1035.1...	**3**	**M1** for $\pi\times9\times16$ oe **M1** for $2\times\pi\times7.86^2$ oe or $3\times\pi\times7.86^2$ oe

Question	Answer	Marks	Partial Marks
4(b)	144.375 final answer	**2**	**B1** for answer 144, 144.3, 144.4, 144.37 or 144.38 or **M1** for 7.5 × 3.5 × 5.5
5(a)	$n + 2n + 2n - 7 = 108$ oe	**B1**	
	39	**B2**	**M1FT** for correct solution of *their* linear equation of form f(n) = 108 **M1FT** for answer (2 × *their* n) – 7
5(b)	$\frac{2v^5}{5}$ final answer	**2**	**B1** for final answer with two of $\frac{2}{5}$, v^5 and t^0 or $\frac{2v^5}{5}$ seen
5(c)	$\frac{x-4}{3x-2}$ final answer nfww	**3**	**B1** for $(x + 4)(x - 4)$ seen **B1** for $(3x - 2)(x + 4)$ seen
6(a)	28 final answer	**1**	
6(b)	$x < \frac{5}{4}$ oe final answer	**2**	**M1** for $8 - 4x > 3$ or $2 - x > \frac{3}{4}$ or better After 0 scored, **SC1** for answer [….]1.25 oe
6(c)	$\frac{8-x}{4}$ oe final answer	**2**	**B1** for $x = 4(2 - y)$ or $\frac{y}{4} = 2 - x$ or $y + 4x = 8$ or better
6(d)	$\frac{4}{7}$ oe	**3**	**M2** for $40 - 20p = 35 - 6p - 3$ or better or $8 - 7 + \frac{3}{5} = 4p - \frac{6p}{5}$ or better or **M1** for $4(2 - p) = 7 - \frac{3(2p+1)}{5}$
7(a)(i)	15	**2**	**B1** for exterior angle = 24° or interior angle = 156° or **M1** for 360 ÷ 24 soi or $\frac{180(n-2)}{n} = 180 - 24$ oe
7(a)(ii)	12°	**2**	**M1** for $x + x + 156 = 180$ oe
7(b)(i)	$\angle Q$ is common, shared or same $\angle PSQ = \angle TXQ$, corresponding angles $\angle SPQ = \angle XTQ$, corresponding angles [Hence similar]	**3**	**B2** for two correct pairs with correct reasons or **B1** for one pair with a correct reason or two correct pairs of angles identified with wrong/no reasons
7(b)(ii)	2 : 3	**1**	

Question	Answer	Marks	Partial Marks
7(b)(iii)	1 : 18 final answer	**2**	**B1** for $\left[\frac{1}{2}\times\right]1:3^2$ oe or $\left[\frac{1}{2}\times\right]\left(\frac{1}{3}\right)^2:1$ oe After 0 scored **SC1** for $\left[\frac{1}{2}\times\right]3^2:1$ oe or $1:\left[\frac{1}{2}\times\right]\left(\frac{1}{3}\right)^2$ oe
8(a)(i)	11.7 or 11.66...	**2**	**M1** for $10^2+(-6)^2$ oe
8(a)(ii)	(23, –14)	**2**	**B1** for one coordinate correct or for $\begin{pmatrix}30\\-18\end{pmatrix}$ seen After 0 scored, **SC1** for (–14, 23)
8(b)(i)	$4\mathbf{p}+\mathbf{q}$	**1**	
8(b)(ii)	$3\mathbf{p}+\frac{3}{5}\mathbf{q}$ oe simplified vector final answer	**2**	**B1** for $\overrightarrow{BX}=\frac{3}{5}\mathbf{q}$ or $\overrightarrow{XB}=-\frac{3}{5}\mathrm{q}$ or **M1** for a correct route along the lines of the diagram
8(b)(iii)	$4\mathbf{p}-\frac{2}{5}\mathbf{q}$ oe simplified vector final answer	**2**	**B1** for $\overrightarrow{CX}=-\frac{2}{5}\mathbf{q}$ or $\overrightarrow{XC}=\frac{2}{5}\mathrm{q}$ or **M1** for a correct route along the lines of the diagram
9(a)(i)	41.4[0] or 41.39...	**3**	**M2** for $[\sin=]\frac{6.4\times\sin 79}{9.5}$ or **M1** for $\frac{6.4}{\sin[...]}=\frac{9.5}{\sin 79}$ oe
9(a)(ii)	26.2[2...]	**3**	**Dep** on 3 marks in (a)(i) or 41.4[0] used **M1FT** for $[\hat{C}=]\,180-79-$ *their* 41.4 **M1** for $\frac{1}{2}\times6.4\times9.5\times\sin(\mathit{their}\hat{C})$ oe
9(b)(i)	63[.0] or 62.97...	**3**	**M2** for $[\cos=]\frac{9.8^2+8.2^2-9.5^2}{2\times9.8\times8.2}$ or **M1** for $9.5^2=9.8^2+8.2^2-2\times9.8\times8.2\times\cos[...]$
9(b)(ii)	38.7 or 38.69...	**2**	**M1** for $\cos[...]=\frac{6.4}{8.2}$

Question	Answer	Marks	Partial Marks
10(a)	$\frac{30}{x}\times 60[=]\frac{1800}{x}$	**1**	e.g. $\frac{30\times 60}{x}[=]\frac{1800}{x}$ or $\frac{30}{\left(\frac{x}{60}\right)}[=]\frac{1800}{x}$
10(b)	$\frac{600}{x-25}-\frac{1800}{x}=8$	**M1**	or $\frac{600}{x-25}=\frac{1800}{x}+8$ or $\frac{600}{x-25}-8=\frac{1800}{x}$
	$600x - 1800x + 45000 = 8x^2 - 200x$ or better	**M1**	**Strict FT** correct elimination of fractions and brackets
	Correct rearrangement to $x^2 + 125x - 5625 = 0$	**A1**	**A0** if any errors or omissions in working
10(c)	$\frac{-125\pm\sqrt{125^2-4\times(-5625)}}{2\times 1}$ oe or $-62.5\pm\sqrt{9531.25}$	**B2**	**B1** for $\sqrt{125^2-4\times(-5625)}$ oe or $\frac{-125\pm\sqrt{their\,38125}}{2\times 1}$ or $(x+62.5)^2$
	35.1, –160.1	**B1**	
10(d)	53[.0] to 53.1 nfww	**3**	**M2** for $\frac{40}{2\times their\,35.1-25}[\times 60]$ oe or **M1** for [time =] $2 \times$ *their* 35.1 – 25 oe